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COMMENTARY

# Collective Openness and Other Recommendations for the Promotion of Research Integrity

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Research integrity is essentially a matter of behavior. It is embodied in the actions and decisions of scientists, rather than in the standards, codes, regulations and norms that aim to shape that behavior. Misconduct and other questionable research behaviors stand in sharp contrast to research integrity. Measures intended to promote research integrity should therefore be held to a behavioral standard. If they promote right behavior, they can be judged successful; if they show no association with proper or improper conduct, or if, paradoxically, they show evidence of increasing the likelihood of misconduct by scientists, then they are not successful.

This behavioral criterion is both simpler and tougher than more common evaluative criteria. Instruction in the responsible conduct of research (RCR) often relies on assessments of students' reactions to hypothetical situations, or their understanding of ethical principles, or their knowledge of policies and rules. It is not often judged in terms of its ability to affect scientists' behavior. Yet, at the very least, we should expect scientists who have been trained in RCR to be less likely to engage in misbehavior of any kind.

My colleagues and I have investigated this proposition, and our results are not encouraging. I summarize our empirical findings here and suggest ways to promote research integrity that appear promising in terms of their potential to shape behavior. Without evidence of behavioral impacts, RCR instruction cannot be relied upon to ensure or promote research integrity.

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## Empirical Evidence

At the World Conference on Research Integrity [1] in Lisbon, September 2007, I reported findings that my colleagues and I published in the same month's issue of *Academic Medicine* [2]. In that study, we addressed the relationship between mentoring and instruction in the responsible conduct of research (RCR) and subsequent engagement in misconduct (fabrication, falsification and plagiarism, "FFP") or questionable research practices. Our analysis was based on a 2002 national survey of U.S. mid- and early-career scientists who had received funding from the National Institutes for Health. We examined scientists' exposure to instruction and five different forms of mentoring (in ethics, research, financial issues, survival in science, and personal issues) in relation to their misbehaviors in eight different categories (data, methods, policy, use of funds, outside influence on research, peer review, intellectual credit, and cutting corners). Our respondents reported on their own misbehavior during the three years prior to the survey.

Instead of providing a solid endorsement of instruction as an inhibitor of misbehavior, our findings were disappointing and cautionary [2]:

- Thirty-seven percent of the mid-career respondents reported that they had had no RCR instruction, either during or after their graduate training. Among the early-career scientists, whose training occurred after the U.S. federal government began requiring RCR instruction of all NIH-funded trainees, 15 percent reported having no such instruction.
- Mid-career scientists who had received instruction were less likely than those who had not to engage in misbehavior in the categories of policy, use of funds and cutting corners.
- Among the mid-career scientists, ethics mentoring was the only form of mentoring that had any significant association with subsequent misbehavior, and it was (negatively) associated only with misbehaviors in the policy category.
- Early-career scientists who had had RCR instruction were *more* likely to engage in misbehavior in the data category than those without instruction. (In separate analyses of FFP alone, the early-career group with instruction proved less likely to engage in FFP misbehaviors.)
- The early-career scientists who reported having received ethics, research or personal mentoring were less likely to have engaged in misbehavior in several categories.
- The early-career respondents who had mentoring in financial matters were *more* likely to engage in misbehavior in the use-of-funds category (but less likely, in other analyses, to engage in FFP).
- In the early-career group, mentoring in the art of survival in science was associated with a *greater* likelihood of having engaged in misbehavior in the categories of methods, use of funds and peer review, as well as FFP.

These findings suggest that RCR instruction and mentoring are less reliable inhibitors of misbehavior in science than one might assume or hope. Either training in responsible science needs to be improved, or other means need to be found to promote integrity in science. My recommendations address both strategies. First, the responsible conduct of research needs to be communicated through good instructional practices. Second, group mentoring may counter some of the ill effects of individual mentoring seen in our study. Third, preparation for survival in the tough, competitive environment of science should accompany RCR training. Fourth, a shift to collective openness in the research culture offers promise as a way to promote research integrity.

## Recommendations

### Good Instructional Practice

Instructors in the responsible conduct of research can rely on guidelines [3], overviews [4–6], and textbooks [7–9] in determining the content of their courses. Indeed, even federal regulations and institutional policies can be instructive, and there are plenty of actual cases that are ripe for analysis.

I suggest, though, that impacts of RCR instruction on behavior have more to do with delivery than with content, simply because it is more problematic. In the U.S., federal agencies that prescribe content have largely left delivery decisions to institutions. Perhaps one of the most basic decisions is whether instruction will be delivered by scientists or by others. Non-scientists who teach RCR to early-career scientists may not have the authority or credibility to command attention and respect. Graduate students and postdocs are in perhaps the narrowest, most-focused stage of their careers, and mandatory instruction that falls outside their specialties may be discounted.

If scientists are given the responsibility for RCR instruction, they often behave like fish out of water. The pedagogical methods they use to teach biochemistry or ecology can be quite incompatible with the content of RCR courses. Even if the issues under consideration are familiar, scientists are generally not accustomed to teaching outside their area of expertise. In the usual tradition of teaching at the college and especially graduate level, one tends to teach as one was taught. Given that 37% of our mid-career respondents report having had no RCR training at all [2], their own experience may not prove useful. In order to get the job done, scientists may resort to uncreative, ineffective teaching styles, such as formulaic lectures, following the book, uninspired case analyses, and so on. If such instruction is onerous and unrewarding, scientists will not enjoy it, and their reluctance and lack of enthusiasm will be apparent to students, who may then conclude that such instruction is a waste of time.

Some institutions rely on neither scientists nor other RCR instructors but on some version of automated or online instruction that they develop in-house or purchase from others [10–12]. Some of these packages provide a wealth of information. They typically assess students' grasp of the course content by multiple-choice tests, but their effectiveness in influencing subsequent behavior has not been established. In fact, even their ability to ensure students' familiarity with the information presented can be questioned, as students are adept at minimizing effort in what they see as a *pro forma* exercise. One of my own students completed in a few minutes an online course that was design to take several hours. She simply ignored most of the content ("It looked like a lot to read"), answered the questions by strategic guessing, and was quickly certified.

The empirical evidence in our study suggests that RCR instruction needs to be more effective. I propose that good instructional practices are critical. Experienced, senior scientists should be involved in, if not wholly responsible for, RCR instruction, but they should not be expected to take on such a task without adequate preparation. They need inspiration and creative approaches to instruction, which can be supplied in part by others with professional interests in the RCR content areas, by master teachers, or by gifted colleagues whose pedagogies could be widely shared to everyone's benefit. Engaging, interactive, thought-provoking, even Socratic instructional approaches are more likely to give students an opportunity to draw their own conclusions and lessons and to apply them to their work, in their own contexts. Interaction with people who have sober or cautionary tales to tell from their own experience can be memorable. Simulations, case analyses, role-playing and other active and interactive strategies are generally more effective than dry didactics in influencing behavior. RCR instruction must also be repeated through the course of graduate training and beyond, and it must be continuously updated to address issues associated with new technologies and policies. It should also be grounded in the reality of scientists' work. Courses that emphasize only sensational cases of outrageous misconduct may lead students to dismiss intended lessons, but courses that focus more attention on "normal misbehavior" [13] or persistent dilemmas are more likely to hold students' attention.

## Group Mentoring

Our empirical results show that some forms of mentoring indeed prove salutary: those with mentoring in the ethics, research and personal categories were less likely to engage in misbehavior [2]. Problems showed up, however, in relation to mentoring for survival in science, that is, mentoring on what it takes to succeed in science. This kind of mentoring is associated with a greater likelihood of misbehavior of several kinds.

We can imagine a mentor quietly telling a student what he or she needs to do to get ahead. Such advice would not necessarily constitute an endorsement of FFP, but might instead suggest the utility of taking methodological shortcuts, providing incomplete methodological details in papers, maintaining a generous interpretation of allowable expenses in funding categories, or short-changing peer-review duties. That these behaviors are associated with survival mentoring but not instruction suggests that students learn about them in confidential, rather than in public, settings.

One means by which institutions might counter the influence of survival mentoring is by promoting group mentoring, that is, mentoring of small teams of students by two or more faculty members. Group mentoring may serve as a check on some of the less ethical suggestions that a scientist might make to a student alone. I spoke recently with a bioscience professor who told me that, in an open discussion among scientists and students, nearly all the scientists said that they thought it was acceptable to use findings from manuscripts or proposals that they had reviewed. As the discussion proceeded and their views were challenged, they recanted and came to collective agreement that such behavior is wholly inappropriate. Being privy to such debates and witnessing changes in perspective among mentors are powerful experiences for students.

Group mentoring brings the weight of social norms, shared expectations, disciplinary culture and common experiences to bear on ethical questions. It is more difficult to advocate and maintain an ethically questionable stance in the context of group scrutiny than in the privacy of a mentor-student relationship. Group pressures can have powerful influences on behavior.

## Preparation for Survival in Science

Analyses that my colleagues and I are preparing for publication show that the relationship between RCR training (either instruction or mentoring) and subsequent misbehavior is overshadowed by a stronger relationship: that between perceptions of competition and misbehavior. In short, the more scientists perceive their fields as competitive, the more likely they are to engage in misbehavior.

This finding, together with our results related to survival mentoring [2], points to problems in the realities of careers in the tough scientific environment. Students need guidance on how to take strategic steps to advance their careers without compromising the integrity of their work [14]. By learning how senior scientists have navigated their way through difficult choices, frustrations and temptations, students gain a better sense of what they need to do to be responsible as well as successful scientists. After all, no scientist can be successful for long, without also being responsible.

Preparation for survival in science can be a component of both instruction and mentoring. Students should learn how to cope with competitive pressures (see Anderson et al. in this issue [15]), while still adhering to high standards for the conduct of research. Survival preparation should call students' attention to career options in science—academic and non-academic—so that they do not invest all of their aspirations in one set of professional goals. It should familiarize students with their discipline's norms for professional relationships, networks and interactions, so that they will benefit in appropriate ways from connections with others in the field. Professional survival is also a matter of knowing the critical details of good research practice, such as laboratory management, financial management, and long-term development of research agendas. Competence in these areas should lessen the incentive to deal with competitive pressures by subverting research integrity.

## Collective Openness in the Research Environment

Instruction cannot cover every problematic issue that might arise in the course of research, and mentors cannot be everywhere. What is needed is a mechanism for sustaining attention to the responsible conduct of research on an everyday basis, in the routine work of laboratories and other research sites. Collective openness is such a mechanism.

Collective openness is a principle of interaction within a research group. It is an expectation that all members of the group (senior scientists, postdoctoral fellows, students, technicians) can and will raise questions about any aspect of the work underway at any time. In an open environment, everyone is not only encouraged but expected to question each others' decisions and work, so that mistakes and oversights, as well as misbehavior, will be noticed and corrected. The members of the research team challenge each other's work out of a collective sense of responsibility for the integrity of the work—as a means of verifying the integrity of the work at hand—and they are applauded for doing so. Collective openness makes integrity an explicit and organic part of everyday science. It demands open discussion of decisions, especially those clouded by difficulty, temptation or ambiguity, and encourages the same skeptical stance toward the conduct of research that scientists apply to scientific findings and methods.

Most scientists want their labs to be places of open inquiry and exchange, and to this end they encourage their associates and students to speak up if they see something that is not quite right [16–17]. The principle of collective openness strengthens this practice by turning general or vague invitations for questions into expectations that questions will be raised, by addressing questions of ethics as well as questions of procedure, and by emphasizing collective responsibility instead of oversight. Senior scientists enact and model collective openness by initiating questioning, responding attentively to concerns that others raise, and monitoring the general balance between trust and skepticism in their labs.

Such openness might seem to border on micro-whistleblowing, but in fact it likely reduces the need for whistleblowing by making all members of a team, no matter what their status, more comfortable about raising questions and concerns. It acts as a kind of pressure valve, so that suspicions do not grow into major concerns that require the attention of authorities. Not even the principle of collective openness will deter all misbehavior, but being on a team whose members constantly ask questions about both procedural and ethical matters fosters greater care, watchfulness and attention to the responsible conduct of day-to-day tasks.

Collective openness is connected to the very idea of research integrity. I argue that research integrity—as right behavior—is indicated by a scientist's ability to answer any reasonable question about any aspect of the research, and how it was done, to the satisfaction of any knowledgeable peer. In short, it is indicated by the ability to withstand scrutiny. Students and other trainees who work in an open environment not only learn the responsible conduct of research by everyday practice, but they become accustomed to collective responsibility as a safeguard against both error and ethical lapses. They come to assume that *not* challenging questionable behavior or decisions is unacceptable.

## Conclusion

Instruction and mentoring in the responsible conduct of research are critical components of the effort to promote research integrity. Novice researchers need a solid foundation for understanding research standards, policies, regulations, laws and norms. Ongoing training reminds experienced researchers how much is at stake in their research and keeps them current on ethical issues associated with new technologies and regulations.

It is inappropriate and inadvisable, however, to put instructional programs in place or to rely on mentoring without ever checking to see how well they are working. Such *pro forma* attention to RCR can lead to complacency, which becomes part of a context in which "normal misbehavior" [13] goes unchecked.

At minimum, we should expect those with instruction and mentoring to be less likely to misbehave, cut corners, or otherwise compromise the integrity of their work. Our chances of ensuring this outcome would improve with better approaches to RCR instruction, group mentoring, strategic attention to career-survival strategies, and collective openness.

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